CLAIMS

I CLAIM:

1. A rotary actuator comprising:

a housing;

an armature containing a permanent magnet with radially north and south poles mounted rotatably in said housing;

a plurality of pole members mounted in said housing, with said pole members journaled around said armature, with said pole members each comprising;

a ferromagnetic material and with at least one of said plurality of pole members having magnetic properties different than the remaining pole members;

a first stop member mounted on said housing;

at least one stop arm, with said stop arm projecting from said armature and disposed to engage said stop member to limit rotation of said armature.

2. The rotary actuator as claimed in claim 1, wherein said housing is made of a ferromagnetic material and said permanent magnet is made of neodymium, samarium, cobalt or other rare earth material.

3. The rotary actuator as claimed in claim 1, wherein at least two of said plurality of pole members further include a winding thereby forming electro-magnetic poles.

4. The rotary actuator as claimed in claim 1, wherein each of said plurality of pole members further include:

an air gap formed between each of said plurality of pole members and said armature, and wherein said at least one of said pole members has magnetic properties different than said remaining pole members and has an air gap differing in size from each of said air gaps formed between the respective remaining poles and said armature.

5. The rotary actuator as claimed in claim 1, wherein each of said plurality of pole members further includes:

a selected shape, with said selected shape of said at least one of said plurality of pole members having magnetic properties different from the respective remaining pole members and having a selected shape different than said selected shape of said respective remaining pole members.

6. The rotary actuator as claimed in claim 1, wherein said at least one of said plurality of pole members further includes a permanent magnet.

7. The rotary actuator as claimed in claim 1, wherein said least one of said plurality of pole members includes:

a non-ferromagnetic material pole; and

a permanent magnet mounted on said non-ferromagnetic material pole member.

8. The rotary actuator as claimed in claim 1, wherein said at least one of said plurality of pole members is made of a non-ferromagnetic material.

9. The rotary actuator as claimed in claim 1, further including:

an armature spaced relatively close to said housing to create a gap between said armature and said housing thereby providing additional winding capability on said pole members for greater drive torque.

10. The rotary actuator as claimed in claim 1 further including air gap adjustment means, with said air gap adjustment means disposed on said at least one of said plurality of pole members.

11. The rotary actuator as claimed in claim 1, further including a plurality of coil windings with said coil windings mounted on selected pole members to perform as electro-magnetic poles.

12. The rotary actuator as claimed in claim 1, with said at least one pole member movably disposed relative to said armature.

13. The rotary actuator as claimed in claim 1, wherein a differential between said magnetic properties of said at least one of said plurality of pole members and said magnetic properties of the remaining pole members defines a failsafe torque.

14. The rotary actuator as claimed in claim 10 wherein said air gap adjustment means includes a threaded pole member threadably engaged in said housing.

15. The rotary actuator as claimed in claim 1 further including a second stop member with said first and said second stop members disposed to limit the motion of said stop arm.

16. The rotary actuator as claim in claim 1 wherein said magnet is made of alnico.

17. The rotary actuator as claimed in claim 1 wherein said housing is made of a magnetic metal and said permanent magnet is made of neodymium, samarium, cobalt or other rare earth material.

18. The rotary actuator as claimed in claim 1 wherein at least one of said plurality of pole members is omitted thereby providing a non-symmetrical configuration of said pole members relative to said armature.